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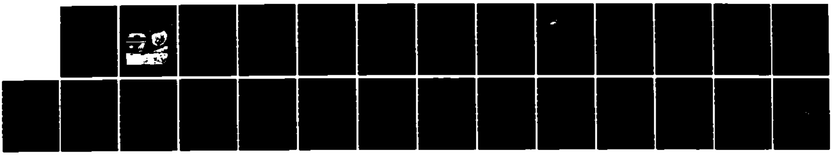

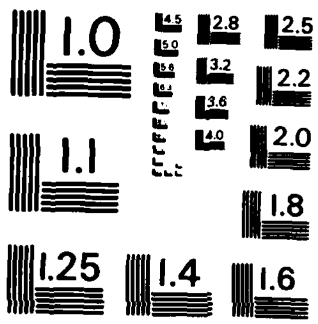

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Biological Report 82 (11.31)
April 1985

TR EL-82-4

Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (Gulf of Mexico)

COMMON RANGIA

Fish and Wildlife Service
U.S. Department of the Interior

Coastal Ecology Group
Waterways Experiment Station
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Species Profiles: Life Histories and Environmental Requirements of Coastal Fisheries and Invertebrates (Gulf of Mexico)

COMMON RANGIA

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PREFACE

This species profile is one of a series on coastal aquatic organisms, principally fish, of sport, commercial, or ecological importance. The profiles are designed to provide coastal managers, engineers, and biologists with a brief comprehensive sketch of the biological characteristics and environmental requirements of the species and to describe how populations of the species may be expected to react to environmental changes caused by coastal development. Each profile has sections on taxonomy, life history, ecological role, environmental requirements, and economic importance, if applicable. A three-ring binder is used for this series so that new profiles can be added as they are prepared. This project is jointly planned and financed by the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service.

Suggestions or questions regarding this report should be directed to one of the following addresses.

Information Transfer Specialist
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or

U.S. Army Engineer Waterways Experiment Station
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Vicksburg, MS 39180

CONVERSION TABLE

Metric to U.S. Customary

Multiply	By	To Obtain
millimeters (mm)	0.03937	inches
centimeters (cm)	0.3937	inches
meters (m)	3.281	feet
kilometers (km)	0.6214	miles
square meters (m^2)	10.76	square feet
square kilometers (km^2)	0.3861	square miles
hectares (ha)	2.471	acres
liters (l)	0.2642	gallons
cubic meters (m^3)	35.31	cubic feet
cubic meters	0.0008110	acre-feet
milligrams (mg)	0.00003527	ounces
grams (g)	0.03527	ounces
kilograms (kg)	2.205	pounds
metric tons (t)	2205.0	pounds
metric tons	1.102	short tons
kilocalories (kcal)	3.968	British thermal units
Celsius degrees	1.8(°C) + 32	Fahrenheit degrees

U.S. Customary to Metric

Multiply	By	To Obtain
inches	25.40	millimeters
inches	2.54	centimeters
feet (ft)	0.3048	meters
fathoms	1.829	meters
miles (mi)	1.609	kilometers
nautical miles (nmi)	1.852	kilometers
square feet (ft^2)	0.0929	square meters
acres	0.4047	hectares
square miles (mi^2)	2.590	square kilometers
gallons (gal)	3.785	liters
cubic feet (ft^3)	0.02831	cubic meters
acre-feet	1233.0	cubic meters
ounces (oz)	28.35	grams
pounds (lb)	0.4536	kilograms
short tons (ton)	0.9072	metric tons
British thermal units (Btu)	0.2520	kilocalories
Fahrenheit degrees	0.5556(°F - 32)	Celsius degrees

CONTENTS

ACKNOWLEDGMENTS

We thank Dr. Courtney T. Hackney, University of North Carolina at Wilmington and Dr. H. Dickson Hoese, University of Southwestern Louisiana, for their critical reviews of the manuscript; T. Dale Bishop and Darryl R. Clark for information and help with the literature search; Mark F. Godcharles, Jake M. Valentine, and personnel of the Alabama State Docks Department and the U.S. Army Corps of Engineers, Mobile District, for providing comments and unpublished reports; Jeanne J. Hartley for her illustration of rangia; and Dr. Robert J. Muncy, Betty Muncy, and Cindy Mills for help in the preparation of the manuscript.

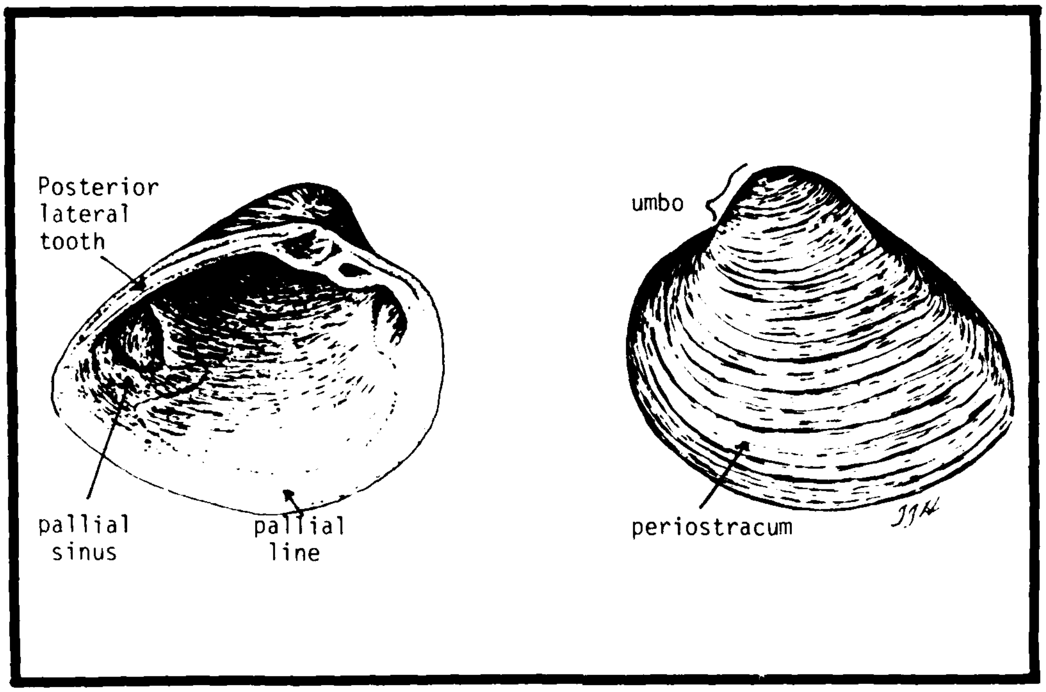

Figure 1. Common rangia.

COMMON RANGIA

NOMENCLATURE/TAXONOMY/RANGE

Scientific name.................Rangia cuneata (Gray) (Figure 1)
Preferred common name...........Common rangia (Andrews 1971; Fotheringham and Brunenmeister 1975)
Other common names............Brackish water clam, Louisiana road clam
Class...........................Mollusca
Order.................Eulamellibranchia
Family........................Mactridae

Geographic range: The common rangia is found along the Gulf of Mexico coast (Figure 2) from northwest Florida to Laguna de Terminos, Campeche, Mexico (Dall 1894; Andrews 1971; Ruiz 1975), and along the Atlantic coast as far north as Maryland (Pfitzenmeyer and Drobeck 1964; Gallagher and Wells 1969; Hopkins and Andrews 1970) and New Jersey (Woodburn 1962). Before 1956, living common rangia had not been collected along the Atlantic coast (Wells 1961) probably because earlier sampling in brackish water areas had been inadequate. Common rangia inhabit low salinity (0 to 18 ppt) estuarine habitats (Parker 1966; Christmas 1973; Hopkins et al. 1973; Swingle and Bland 1974).

Geologically, the common rangia has been found in Pliocene deposits in the Carolinas and Florida and in Pleistocene deposits in Chesapeake Bay and the Potomac River, the Carolinas, Florida, the entire north coast of the Gulf of Mexico (Figure 2), and the north coast of South America (Conrad 1840; Dall 1894; Maury 1920; Richards 1939).

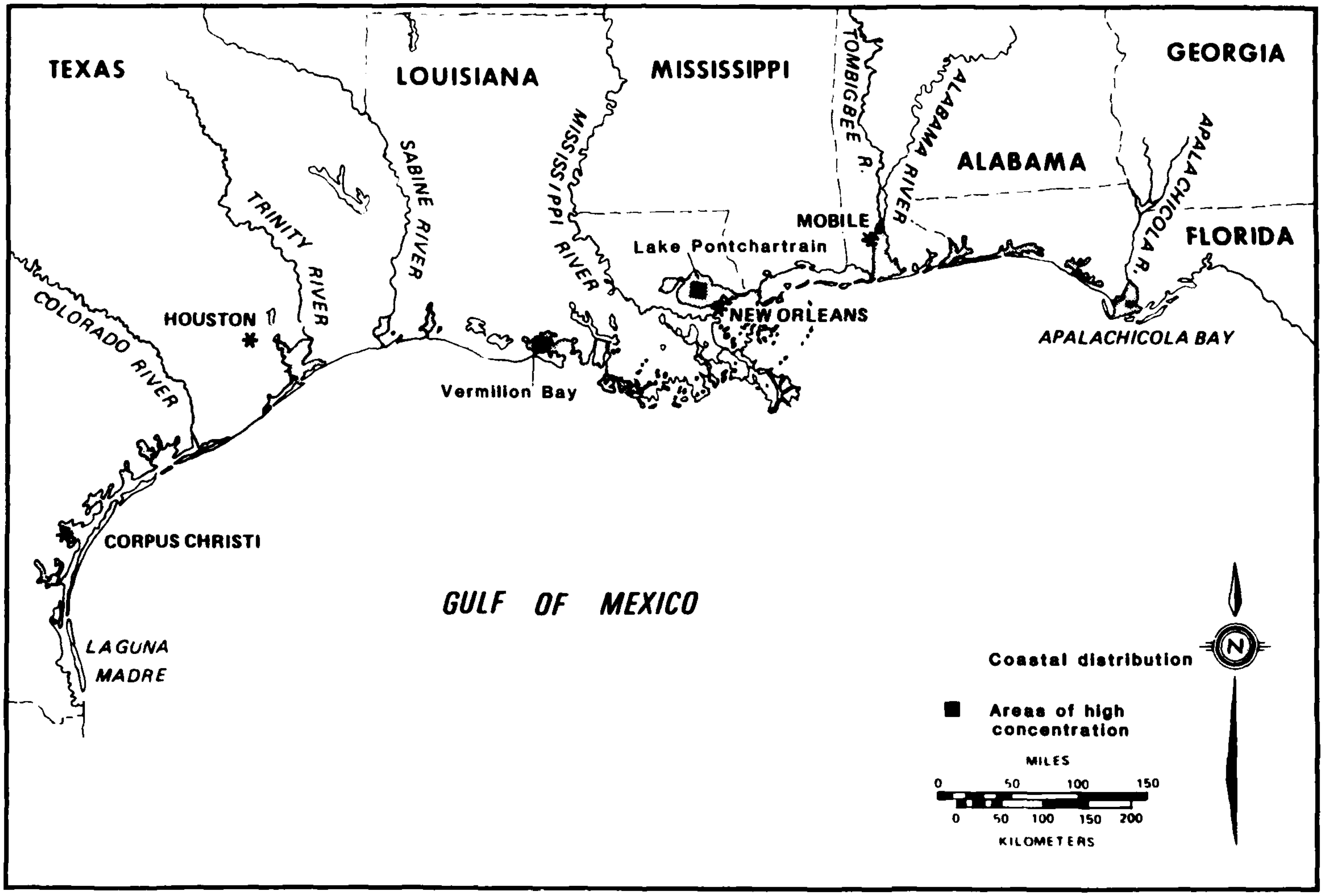

Figure 2. Distribution of common rangia along the northern coast of the Gulf of Mexico.

MORPHOLOGY/IDENTIFICATION AIDS

The following description of common rangia is taken from Abbott (1954) and Andrews (1971, 1981). Adults range from 2.5 to 6.0 cm in length. The valves are obliquely ovate, thick, and heavy (Figure 1). The exterior of the shell is covered with a strong, rather smooth periostracum that ranges from light brown to grayish brown to black. The umbones are prominent and are near the anterior end. The shell interior is glossy white with a blue-gray tinge. The pallial sinus is small but distinct. The posterior lateral tooth is long (Figure 1). Dall (1894) mentions that most of the variability in form is related to the differences in the height of the umbones and the shape of the posterior margin of the shell. Rangia cuneata var. nasutus (Dall 1894) is believed to be a rostrate form of R. cuneata (Abbott 1954) and may be confused with a closely related species, the brown rangia (Rangia flexuosa [Conrad]). The brown rangia is 2.5 to 4.0 cm long and resembles an elongate common rangia; however, brown rangia can be easily separated from common rangia by the short posterior lateral tooth and the nondistinct pallial sinus. Brown rangia is found from Louisiana to Texas and Vera Cruz, Mexico (Andrews 1971), but is much less common than the common rangia.

REASONS FOR INCLUSION IN SERIES

The common rangia is an important component of estuarine ecosystems (Parker 1959; Odum 1967; Odum and Copeland 1969; Copeland et al. 1974) accounting, for example, for nearly 95% of the benthic biomass in the James River Estuary, Virginia (Cain 1975). In low salinity estuarine areas common rangia functions as a link between primary producers and secondary consumers. As a non-selective filter feeder, rangia transforms large quantities of plant detritus and phytoplankton into clam biomass (Darnell 1958; Olsen 1972, 1973, 1976a; Hoese 1973). In turn, this biomass is consumed by fishes, crustaceans, and ducks (Suttkus et al. 1954; Darnell 1958; Gunter and Shell 1958; Harmon 1962; North Carolina Bureau of Sport Fisheries and Wildlife 1965; O'Heeron 1966; Cain 1972; Tarver and Dugas 1973). The shells provide hard substrate for epifaunal attachment (Hoese 1973).

The common rangia was a food item of prehistoric Indians (McIntire 1958) and it is still occasionally canned and eaten in New Jersey, Texas, North Carolina, and Mexico (Singley 1893; Woodburn 1962; Wass and Haven 1970; U.S. Department of Commerce 1971). Economically, common rangia is more important as a source of shells for road building and in the manufacture of many industrial products (Tarver and Dugas 1973; Swingle and Bland 1974; Arndt 1976). Much of this shell material is dredged from buried deposits in estuaries.

LIFE HISTORY

Spawning

The reproductive cycle and environmental conditions necessary for spawning are well known for common rangia. The reproductive cycle was studied in Louisiana by Fairbanks (1963), in Virginia by Cain (1975), in Florida by Olsen (1976b), and in Campeche, Mexico by Rogers and Garcia-Cubas (1981). Most rangia spawned from March to May and from late summer to November in Louisiana and from February to June and September to November in Mexico. In both areas, spawning may be continuous.

In Virginia, gametogenesis began in early April and continued throughout the summer; gametes were ripe from May through November. Gametogenesis was initiated when water temperature rose to 15°C, and spawning was initiated by a rapid increase or decrease in salinity (Cain 1975). In upstream areas of the James River,

Virginia, clams required a salinity increase of about 5 ppt associated with reduced freshwater output, but in downstream areas they required a salinity decrease of about 10 to 15 ppt associated with increased freshwater output. Spawning peaked at 5 ppt in fall. In Florida, ripe gametes and spawning were reported from July through November; spawning peaked in September. Temperature and salinity increases were suspected of triggering spawning (Olsen 1976b).

In spawning, common rangia release gametes directly into the water. Sex ratios were reported to be near 1:1 in Louisiana (Fairbanks 1963) and Mexico (Rogers and Garcia-Cubas 1981), but females outnumbered males in Virginia (Cain 1972). The incidence of hermaphroditism in this clam was reported to be 0.1% in Mexico (Rogers and Garcia-Cubas 1981) and 2.1% in Florida (Olsen 1976b). The minimum length of mature adults in Lake Pontchartrain, Louisiana, was 24 mm (Fairbanks 1963). From data on annual growth increments, Fairbanks (1963) inferred that a clam could reach minimum length in 2 to 3 years. In the James River, Virginia, Cain (1972) reported that gonads were mature in clams as small as 14 mm, which were probably clams in their second year of life.

No fecundity data are available on common rangia.

Larvae and Postlarvae

The early stages of development of common rangia were studied in Louisiana by Fairbanks (1963) and in Virginia by Chanley (1965). Fairbanks reported that the average diameter of eggs was about 69 μm. Ciliated blastula developed 3.5 hours (h) after fertilization, a pelagic trochophore at 26.3 h, and a veliger at 34.3 h (93 μm in mean diameter). In Virginia, Chanley reported that shelled larvae appeared within 24 h after fertilization. The length of different life stages were as follows: straight-hinged larvae 0.75 to 130 μm; unbowed larvae 120 to 175 μm; and pediveligers (metamorphosed) 160 to 175 μm. Pediveligers began to settle, lose the velum, and attain gills at 175 to 180 μm. Metamorphosis began after 7 days (Chanley 1965).

Most settling of larvae in the James River, Virginia, took place between September and March when the animals were 230 to 500 μm long and averaged 300 μm (Cain 1975). A second settling period occurred in midsummer. In Lake Pontchartrain, Louisiana, Fairbanks (1963) collected juveniles as small as 375 μm while Hoese (1973) observed several small clams (< 1 mm long) attached to a hydroid colony.

How the juvenile rangia disperse is uncertain. They may be transported to upstream areas in the more saline bottom water in an incoming tide, or by swimming during low flow or both (Cain 1975). Fairbanks (1963) reported that larvae were capable of selecting substrate for setting and preferred substrates high in organic content.

Adult Activity and Feeding

Common rangia move little after settling. Fairbanks (1963) observed little movement of clams in aquaria. Sikora et al. (1981) suggested that rangia are capable only of vertical movement in the sediment. Olsen (1973) reported that clams did not move in aquaria over a 4-month period even when given a choice of substrates.

Feeding of common rangia is controlled by gill palp articulations and ciliary currents over the gills (Olsen 1972). The animal extrudes pseudofeces from the mantle cavity, through the inhalant siphon when the valves are quickly closed.

Life Span

The life span of the common rangia has not been confirmed. If one relates the mean length (about 40 mm) of rangia

collected in Louisiana (Table 1), to estimates of growth rate (Fairbanks 1963; Wolfe and Petteway 1968), the average life span is about 4 to 5 years. A clam of the maximum expected length of 75 mm, reported by Wolfe and Petteway (1968) in Chesapeake Bay, would be 10 years old. Hopkins et al. (1973) estimated a maximum life span of 15 years.

GROWTH CHARACTERISTICS

Growth Rate

Annual growth increments of common rangia in the Gulf of Mexico are reported to vary from 0 to 20 mm (Fairbanks 1963; Gooch 1971; Tarver and Dugas 1973). Annual growth increments, estimated for the first 3 years of life for two populations in Lake Pontchartrain, Louisiana, were 15 to 20 mm, 5 to 9 mm, and 4 to 5 mm, respectively (Fairbanks 1963). From mean height data for clams collected in Lake Pontchartrain, Tarver and Dugas (1973) reported as much as 7.2 mm growth in a 2-month period. This rapid growth appeared to be related to warm temperatures. Annual growth rates have been reported to range from 0 to 9.7 mm for Vermilion Bay, Louisiana (Gooch 1971) and to be 3 mm in Trinity Bay, Texas (Bedinger 1974). Wolfe and Petteway (1968) calculated the following von Bertalanffy growth curve for a common rangia population in the Trent River, North Carolina: $L = 75.62 (1-0.995\ e^{-0.0193t})$. The largest predicted length of 75.6 mm would represent 10 years of growth.

Size

Maximum length reported was 94 mm for a common rangia from Grand Gosier Island, Louisiana (H.D. Hoese, Univ.

Table 1. Range of lengths (mm) or heights (mm) of common rangia examined in four areas of Louisiana.

Area	Length	Height	References
Lake Pontchartrain, LA	38-42 (adults)	---	Fairbanks (1963)
	1-8 (juveniles)	---	
	---	28	Tarver (1972)
	---	28-44	Tarver & Dugas (1973)
Lake Maurepas, LA	---	26	Tarver (1972)
	---	25-27	Tarver & Dugas (1973)
Vermilion Bay, LA	31-61	---	Gooch (1971)
Sabine Lake - Atchafalaya Bay, LA	28-57	---	Hoese (1973)

Southwestern La.; pers. comm.). Mean sizes (length, anterior to posterior; height, umbo to ventral margin) reported from other Louisiana estuaries are shown in Table 1. Parker (1960) and Hoese (1973) reported that the largest clams were found in the lower salinity areas of estuaries, whereas, Tarver and Dugas (1973) found that clam size increased with salinity. In Virginia, Cain (1972) noted that clams living in sand were typically larger than those living in mud.

THE FISHERY

The foremost commercial value of common rangia is in the use of fossil shells for road building material, oyster cultch, and as a source of calcium carbonate for the manufacture of glass, chemicals, chicken and cattle feed, wallboard, and agricultural lime (Tarver and Dugas 1973; Swingle and Bland 1974; Arndt 1976). Clam shells are harvested by large commercial hydraulic dredges. By far the largest concentrations of living clams are along the Louisiana coast. The minimum standing crop of clams estimated to be between the Atchafalaya River and Sabine Lake, Louisiana, was between 24 billion and 48 billion clams (Hoese 1973). Because of the relatively slow growth rate of rangia, Hoese (1973) suggested that no more than 5% of the living clam population should be harvested annually if current production of fossil shells is to be maintained; however, at an annual recruitment of 5% (Fairbanks 1963) the estimated shell deposits in Lake Pontchartrain would be nearly exhausted in 35 years; at 3% Tarver and Dugas (1973) estimated depletion in 18 years.

The potential sources of common rangia shell along the gulf coast have been listed by Arndt (1976). In Texas, shell occurs in the upper reaches of San Antonio Bay, Nueces and Lavaca Bays, Galveston Bay, Trinity Bay, and Sabine Lake. In Louisiana, deposits extend from Point au Fer (Atchafalaya Bay) west to the Texas border, Calcasieu and Sabine Lakes, and Lake Pontchartrain. In Mississippi, clams live in the Pearl River Estuary and Mississippi Sound; in Alabama, in upper Mobile Bay; and in Florida in Choctawhatchee Bay, Tampa Bay, the Caloosahatchie River (Arndt 1976), and the upper reaches of Charlotte Harbor (Woodburn 1962).

The Louisiana Wildlife and Fisheries Commission (1968) estimated a statewide production of about 5 million cubic yards of clam shell in 1968 compared with 300,000 cubic yards annually in the mid-1930's. The maximum annual harvest of shell in the gulf States was 21.2 million tons in 1967 compared with 468,000 tons in 1912 (Arndt 1976). Of the material dredged in 1967, an estimated 12.2 million tons was used in construction and the remainder for road base, asphalt fill, poultry grit, cattle roughage, filter material, and whiting (pigment).

Native Americans used common rangia as food, as evidenced from shell deposits in Indian middens along the gulf coast (Singley 1893; McIntire 1958). The canning of rangia in Texas under the name of "little neck clams" by the Givens Oyster Company was reported by Singley (1893). Rangia were also canned at Cape May, New Jersey (Woodburn 1962) and in North Carolina (U.S. Department of Commerce 1971). Rangia have been collected and consumed from the Potomac Creek of the Potomac River, Maryland (Pfitzenmeyer and Drobeck 1964), to Mexico where Wass and Haven (1970) reported that this clam was served with rice as "Paella a valencianna" in restaurants. The potential use of this clam as food, however, is severely limited by contamination of large potential sources by pollution (Christmas 1973; Swingle and Bland 1974). Rangia are also used as bait for blue crabs (Godcharles and Jaap 1973).

ECOLOGICAL ROLE

Trophic Level

Common rangia serve to link primary producers and secondary consumers in estuarine areas. Rangia are non-selective filter feeders (Darnell 1958; Olsen 1976a) ingesting large quantities of detritus and phytoplankton. Darnell (1958) reported that gut contents contained 70% unidentifiable detritus, 10% sand, 17% algae (possibly *Anabaena* or *Microcystis*) as well as traces of diatoms, foraminifera, and vascular plant material. Olsen (1976a) reported 48 species of phytoplankton from stomach contents of common rangia, although a large portion of the material ingested was detritus (46 to 81%, depending on tidal conditions).

Predators and Parasites

Common rangia are preyed upon by fish, crustaceans, mollusks, and ducks (Table 2; Suttkus et al. 1954; Darnell 1958; Gunter and Shell 1958; Harmon 1962; North Carolina Bureau of Sport Fisheries and Wildlife 1965; O'Heeron 1966; Cain 1972; Tarver and Dugas 1973). In addition, moon shell snails (*Polinices* spp.) may be predators as suggested by drill holes in rangia shells (Hoese 1973). Common rangia are abundant in the diets of blue catfish, freshwater drum, spot, black drum, river shrimp, and blue crab in Lake Pontchartrain, Louisiana (Darnell 1958, 1961). The smaller rangia are subjected to the greatest predation pressure. Clams as large as 40 mm (length or height), however, are eaten by fishes such as sheepshead and black drum (Darnell 1958; Tarver and Dugas 1973). A potential group of predators not mentioned by the above authors are the ctenophores (i.e., *Mnemioposis*) which sometime appear in tremendous numbers at certain times of the year (M.W. LaSalle, pers. observ.). Ctenophores can cause mass mortality of larvae if coincidental with rangia spawning.

The common rangia is parasitized by larvae of fellodistomatid trematodes (Fairbanks 1963). Cercariae and sporocysts of this parasite are found in the gonadal tissue, giving it an orange coloration and effecting castration. Only large clams are infected.

Competitors

Potential competitors of common rangia may be reduced by the wide range of salinities tolerated by this clam (Odum 1967). *Polymesoda caroliniana* has feeding habits identical to those of rangia (Olsen 1973, 1976a), but is spatially separated from rangia; it is found primarily in intertidal areas or in small numbers in the shallow nearshore subtidal areas. In contrast, rangia live largely in the subtidal zone. Other potential competitors are apparently not adapted to fluctuating salinities.

Spatial Distribution

Common rangia are primarily restricted to low salinity (< 19 ppt) estuaries (Maury 1920; Pulley 1952; Parker 1955, 1956, 1960; Moore 1961; Parker 1966; Odum 1967; Christmas 1973; Hoese 1973; Hopkins 1970; Hopkins et al. 1973; Swingle and Bland 1974). Rangia have been reported from areas as far as 25 miles upstream in delta rivers (Swingle and Bland 1974), but most prefer salinities of 5 to 15 ppt. Tarver and Dugas (1973) found that concentrations of clams were highest adjacent to a potential source of fresh or salt water, which may be related to the need for salinity shock required for spawning (Cain 1973). Concentrations of clams were greatest around the periphery of Lake Pontchartrain and Lake Maurepas (Tarver 1972; Dugas et al. 1974). Dispersion of adult clams is commonly clumped

Table 2. Reported predators of adult and juvenile common rangia.

Species/common name	Adults	Juveniles (<5 mm)	References
Aythya affinis -- lesser scaup duck		X	4,5
Aythya marila -- greater scaup duck		X	5
Aythya collaris -- ring-necked duck		X	5
Anas rubripes -- American black duck		X	5
Anas platyrhynchos -- mallard		X	5
Oxyura jamaicensis -- ruddy duck		X	5
Dasyatis sabina -- Atlantic stingray		X	2
Lepisosteus productus -- spotted gar		X	1,2
Lepisosteus spatula -- alligator gar		X	1,2
Lepisosteus osseus -- northern longnose gar		X	1,2
Dorosoma cepedianum -- gizzard shad		X	1,2
Anchoa mitchilli -- southern bay anchovy		X	1,2
Arius felis -- sea catfish		X	1,2
Ictalurus furcatus -- blue catfish		X	1,2,3
Aplodinotus grunniens -- freshwater drum		X	1,2
Leiostomus xanthurus -- spot		X	1,2
Micropogonias undulatus -- Atlantic croaker		X	1,2
Pogonias cromis -- black drum	X		1,2
Archosargus probatocephalus -- sheepshead	X	X	1,2
Lagodon rhomboides -- pinfish		X	2
Paralichthys lethostigma -- southern flounder		X	1,2
Cynoscion arenarius -- sand seatrout		X	1
Chasmodes bosquianus -- striped blenny		X	7
Penaeus setiferus -- white shrimp		X	1,2
Macrobrachium ohione -- river shrimp		X	2
Callinectes sapidus -- blue crab	X	X	1,2,7
Rhithropanopeus harrisii -- mud crab		X	7
Thais haemastoma -- oyster drill	X		6
Polinices spp. -- moon shell (possible)	X		8

References: (1) Suttkus et al. (1954); (2) Darnell (1958); (3) Gunter and Shell (1958); (4) Harmon (1962); (5) North Carolina Bureau of Sport Fisheries and Wildlife (1965); (6) O'Heeron (1966); (7) Cain (1972); (8) Hoese (1973)

whereas juveniles may be distributed more uniformly (Fairbanks 1963).

Density

The density of clams varies greatly (for reasons discussed later). The highest density of adult clams was $818/m^2$ in Lake Maurepas, Louisiana (Tarver and Dugas 1973), and $238/m^2$ in Vermilion Bay, Louisiana. Average density of clams from shallow water areas between the Atchafalaya River and Sabine Lake was $11.1/m^2$ for adults, $14/m^2$ for juvenile clams > 10 mm, and $28/m^2$ for juvenile clams < 10 mm (Hoese 1973). Densities as high as

129/m^2 were reported in Texas bays (Odum 1967). A mean density of 250/m^2 was reported in the Nueces River, Texas (Hopkins and Andrews 1970). In Lake Pontchartrain, Louisiana, mean densities ranged from 2.7 to 31/m^2 for large clams and 1807 to 1888/m^2 for juveniles (Fairbanks 1963).

ENVIRONMENTAL REQUIREMENTS

A combination of low salinity, high turbidity, and a substrate of sand, mud, and vegetation appears to be the most favorable habitat for the common rangia (Tarver 1972). This clam may be one of the few freshwater clams to become established in brackish water (Ladd 1951). Conversely, Remane and Schlieper (1971) considered common rangia as belonging to a marine group that has become adapted to brackish water.

Temperature

Winter kills in the shallow waters of Chesapeake Bay suggest that common rangia had reached its limit of temperature tolerance there (Gallagher and Wells 1969). Cain (1975) reported that water temperature was the most important factor stimulating gametogenesis. He also stated that the planktonic existence of larvae is greatly extended by low temperature.

Salinity

Common rangia are concentrated in areas where salinity seldom exceeds 18 ppt (Maury 1920; Pulley 1952; Parker 1956, 1960; Moore 1961; Parker 1966; Odum 1967; Godcharles and Jaap 1973; Hoese 1973; Swingle and Bland 1974). Tarver and Dugas (1973) reported a negative correlation (r = 0.71) between density of clams and salinity and a positive correlation (r = 0.81) between clam height and salinity (0 to 6 ppt). Godcharles and Jaap (1973) found a greater number of size classes and larger clams at low salinities (0 to 2 ppt) than at higher ones in Florida and suggested that this range was optimal.

Common rangia have developed physiological responses to the frequent and sudden salinity changes present in many estuaries. Common rangia is an osmoconformer at salinities greater than 10 ppt, and an osmoregulator at lower salinities (Bedford and Anderson 1972a,b; Otto and Pierce 1981a,b). A number of amino acids (including alanine, glycine, glutamic and aspartic) are concentrated at high salinities suggesting that an amino acid pool is used for osmoregulation (Simpson et al. 1959; Allen and Awapara 1960; Allen 1961; Anderson and Bedford 1973; Anderson 1975).

Temperature and Salinity

Cain (1972, 1973, 1974) tested the combined effects of temperature (8 to 32°C) and salinity (0 to 20 ppt) on embryos and larvae of common rangia. Embryos failed to develop at 0 ppt salinity. The optimum conditions for embryos were temperatures of 18 to 29°C and salinities of 6 to 10 ppt.

Larvae survived at all combinations of temperature and salinity tested (except at 0 ppt). They tolerate temperatures of 8 to 32°C and salinities of 2 to 20 ppt. Growth of larvae was best at high salinity (10 to 20 ppt) and high temperature (20 to 32°C). Straight-hinged larvae were found to be more tolerant than embryos to extremes of temperature and salinity.

Oxygen

Common rangia can withstand anoxic conditions as reported by Chen and Awapara (1969) in studies of glycolysis; however, rangia are intolerant of exposure to air (Olsen 1976b).

Substrate

Common rangia are found in a wide range of soft substrates in the northern Gulf of Mexico. Tenore et al. (1968), who studied the effects of clay, silt, and sand substrates on the common rangia, found clay and silt to be unfavorable, whereas Cain (1975) commonly found clams in silty-clay sediments. Parker (1966) found clams on sand, silt, and clay sediments where these constituents did not exceed 80, 30, and 65%, respectively. Few clams were collected from hard sand or clay bottoms in Louisiana (Tarver 1972) or in Alabama (Swingle and Bland 1974). In Louisiana, the numbers of common rangia were highest in a mixture of sand, mud, and vegetation (Tarver 1972), whereas in Alabama, dense populations lived in compacted sandy-clay areas (Swingle and Bland 1974). In Florida, common rangia were collected from soft mud (Godcharles and Jaap 1973; Woodburn 1962), but in Georgia, clams were found in mud or soft mud-sand combinations (Godwin 1968).

The importance of organic matter in the sediment to common rangia is not clear. Fairbanks (1963), who found the largest densities of rangia in highly organic sediments in Lake Pontchartrain, Louisiana, suggested the large amounts of associated bacteria helped to attract and support clams. High organic content in sediments was also favorable for rangia in Vermilion Bay, Louisiana (Gooch 1971). However, no correlation existed between the abundance of common rangia and the percentage of organic matter in the sediment at levels below 10% (Hoese 1973). Few clams were found in sediments with more than 10% organic matter in Louisiana (Hoese 1973) and Alabama (Swingle and Bland 1974). Mortality of rangia can result from shell erosion, which can be accelerated in highly aerated sediments in which carbonic acids are released (Tarver and Dugas 1973).

The substrate of some coastal waters is mainly shells which are often dredged commercially. For example, the common rangia makes up much of the hard substrate of Lake Pontchartrain in Louisiana. The effects of shell dredging on the substrate and benthos are too complex and controversial to discuss in this profile. See Dugas et al. (1974), Taylor (1978), Sikora et al. (1981), and Sikora and Sikora (1982).

Depth

The highest concentration of clams along the gulf coast has been associated with shallow water areas less than 6 m deep (Tarver 1972; Hoese 1973; Godcharles and Jaap 1973; Tarver and Dugas 1973; Dugas et al. 1974). Tarver and Dugas (1973) observed a general decrease in density as depth increased from 2.5 to 4.6 m.

Effects of Pollution

Common rangia are known to concentrate chemicals such as kepone. Lunsford (1981) reported that peak kepone levels in common rangia during summer, in the James River Estuary, were related to increased metabolism and feeding rate. The concentration of kepone was 2 to 4 times greater in rangia than in the water column (Lunsford and Blem 1982). The key factors affecting kepone uptake were water temperature, dissolved oxygen concentration, lipid index of clam tissue, turbidity, kepone concentration in the water, and the duration of exposure (Lunsford and Blem 1982). Kepone is adsorbed by particulate matter, which enhances its uptake by filter feeders such as common rangia. Uptake of oil related products such as benzopyrene, naphthalenes, and various aromatic hydrocarbons has also been reported (Cox 1974; Neff et al. 1976). All of these compounds were accumulated primarily in the viscera and fat bodies of clams under direct exposure and most were readily released when clams were

returned to clean water. Low levels of these contaminants, however, were retained by the clams in each case. The effects of low concentrations of contaminants on common rangia are not known.

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16. Abstract (Limit: 200 words)

Species profiles are literature summaries of the taxonomy, morphology, range, life history, and environmental requirements of coastal aquatic species. They are designed to assist in environmental impact assessment. The common rangia (Rangia cuneata) is a common inhabitant of shallow, low salinity (zero to 18 ppt) estuaries along the northern Gulf of Mexico. The population density of rangia may exceed 1000 clams/m^2. Rangia spawn between March and November, following a sudden rise or fall of salinity of 5 to 10 ppt. Juvenile clams develop rapidly, settling after about 7 days. Juveniles tolerate salinity and temperature extremes of 2 to 20 ppt and 8 to 32 °C. The growth rate of clams ranges from zero to 20 mm per year depending on conditions. Clams may live 15 years or more, attaining a maximum length of about 94 mm. Rangia are found in a wide range of substrate from sand to soft mud. Rangia are filter feeders, ingesting large amounts of detritus and phytoplankton, and are the prey of a large number of fish, crustaceans, mollusks, and ducks. Deposits of fossil shell material are dredged for a number of industrial purposes.

17. Document Analysis a. Descriptors

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Rangia cuneata
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